



M.Sc. NETWORKING & INFORMATION TECHNOLOGY

SYLLABUS

**THOSE WHO JOINED FROM THE ACADEMIC
YEAR
2026 - 2027**

MANONMANIAM SUNDARANAR UNIVERSITY
THIRUNELVELI – 627 012

MSU

**MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI
PG COURSES–AFFILIATED COLLEGES
M.Sc. NETWORKING & INFORMATION TECHNOLOGY
OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM
(with effect from the academic year 2026-2027)**

1. VISION

"To provide quality education to reach the un-reached"

2. MISSION

- ❖ To conduct research, teaching and outreach programmes to improve conditions of human living
- ❖ To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- ❖ To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- ❖ To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

3. PREAMBLE

Outcome Based Education (OBE) is the order of the day in all Higher Education Institutions to emphasize quality mandate. Curriculum tailored with Choice Based Credit System (CBCS) for ensuring flexibility; Exposure to learning opportunities using the latest technological advancements to the learners for continuous lifelong learning; and Adoption of Revised Bloom's Taxonomy (RBT) in the assessment mechanism are essential to add value to the existing OBE. The current revision is aimed at providing scope for effective implementation of OBE by including Programme Educational Outcomes, Programme Outcomes, and Programme Specific Outcomes in alignment to the vision and mission of the University. Courses need to be framed and mapped such that the compilation of the Outcomes of all Courses in the programme ensures the attainment of the programme outcomes in terms of RBT.

The Master of Science in Networking and Information Technology (M.Sc. NIT) programme is designed to provide advanced knowledge and practical expertise in computer networks, information systems, cybersecurity, cloud computing, data communication, and emerging information technologies. The programme aims to develop highly skilled professionals capable of designing, implementing, managing, and securing modern networked environments while

addressing the technological challenges of an increasingly connected world. The curriculum integrates theoretical foundations with hands-on laboratory experience, industry-oriented projects, research activities, and professional training. It emphasizes critical thinking, problem-solving, innovation, and ethical practices in the development and deployment of information technology solutions. Students are exposed to contemporary trends such as network virtualization, cloud infrastructure, Internet of Things (IoT), artificial intelligence applications in networking, information security, and digital transformation technologies. The programme seeks to prepare graduates for careers in network administration, system engineering, cybersecurity, cloud services, IT management, software and infrastructure development, research, and academia. It also encourages lifelong learning and professional growth, enabling graduates to adapt to rapidly evolving technological environments and contribute effectively to industry, government, and society.

By fostering technical competence, analytical abilities, leadership qualities, and a commitment to professional ethics, the M.Sc. Networking and Information Technology programme aims to produce competent IT professionals and researchers capable of driving innovation and supporting the digital economy in a global context.

4. PROGRAMME EDUCATIONAL OUTCOMES (PEOs)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues

PEO3: Habituating ethical values among the learners to succeed in personal and professional life

5. PROGRAMME OUTCOMES (POs)

After the successful completion of Post graduate Programme from the University, the learner should be able to

PO1: Comprehend the knowledge acquired and share the knowledge with others to convince them in a discussion.

PO2: Analyze and compare the factual data / situation and formulate the problem in to a conceptual model to critically evaluate for finding solution.

PO3: Apply the theories and philosophies learned in formulating theoretical research problem with underlying assumptions and solve the problem scientifically.

PO4: Think reflectively on the earlier attempts for applications of the concepts with a sense of inquiring practices and attempt for self directed lifelong learning process.

PO5: Understand the existence of multicultural practices and global viewpoint and utilization of knowledge with the ability to prolong moral/ethical values in personal and professional life.

PO6: Explore through multiple sources and get exposed to the digital literacy and information explosion with latest technology.

PO7: Act as a responsible member in the varied teams with facilitating capability and formulate teams as a leader for defined purposes.

6. PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Advanced IT Communication & Technical Advocacy

Demonstrate the ability to articulate complex network architectures, cloud infrastructures, and IT protocols clearly, enabling effective collaboration and the power to convince stakeholders during technical debates, project proposals, and system design defenses.

PSO2: Network Modeling & System Problem Formulation

Analyze real-world data traffic, security vulnerabilities, and network performance metrics to abstract and formulate them into conceptual IT models, allowing for critical evaluation and optimal system design solutions.

PSO3: Theoretical Application & Scientific Computing

Apply foundational computing theories, cryptographic principles, and network philosophies to formulate research-oriented problems, testing hypotheses scientifically through simulations, mathematical models, and rigorous prototyping.

PSO4: Reflective Engineering & Continuous IT Adaptation

Critically reflect on legacy network deployments, historical cyber-attacks, and past IT frameworks to practice self-directed, lifelong learning, ensuring seamless adaptation to evolving next-generation technologies.

PSO5: Socio-Ethical IT Governance & Global Standards

Design and manage IT infrastructures that respect multicultural user environments, conform to global IT compliances (like GDPR or ISO standards), and uphold strict digital ethics, data privacy, and moral responsibilities.

PSO6: Next-Gen Digital Literacy & Data Exploitation

Leverage cutting-edge IT tools, automation scripts, and big data analytics to navigate the information explosion, master diverse digital platforms, and extract actionable intelligence from multiple high-tech sources.

PSO7: Collaborative Network Management & IT Leadership

Function effectively as a core specialist or cross-functional leader within diverse DevOps, cybersecurity, or IT infrastructure teams, driving project success with strong facilitation skills and strategic technical leadership.

7. PROGRAMME DETAILS

Eligibility Criteria:

Candidates who have studied Bachelor's degree in relevant disciplines like B.Sc. in IT/CS/Mathematics/Statistics, and BCA from recognized university are eligible for this programme (as specified in the admission guidelines given by the Directorate of Collegiate Education 2026-2027 www.tndce.tn.gov.in)

Duration of the Course:

M.Sc. Networking & Information Technology is a 2 years full time programme spread over four semesters.

8. EXAMINATION SCHEME

Scheme of Evaluation (THEORY): Core/Elective/ Skill Enhancement Courses
Total Marks:100 (Internal:25Marks, External:75Marks)

There is no Passing Minimum for the CIA component. But overall(CIA+ External), the student should get 50% or more to get a pass		
CIA-Internal Marks		External Marks
Average of best two tests from three:		End Semester Examination
15 Marks		
Assignment: 05 Marks		
Seminar: 05 Marks		
Total: 25 Marks		Total : 75 Marks

Scheme of Evaluation (PRACTICAL): Core/ Skill Enhancement Course
Total Marks:100 (Internal:50Marks, External:50Marks)

There is no Passing Minimum for the CIA component. But overall(CIA+ External), the student should get 50% or more to get a pass		
CIA-Internal Marks		External Marks
Completion of Practical in time : 20Marks		End Semester Practical Examination
Model Practical Test : 20Marks		
Completion of Record work : 10 Marks		
Total: 50 Marks		Total: 50 Marks

Scheme of Evaluation (PROJECT)

Total Marks:100 (Internal:50Marks, External:50 Marks)

There is no Passing Minimum for the CIA component. But overall(CIA+ External), the student should get 50% or more to get a pass	
CIA-Internal Marks	External Marks
Completion of Project in time : 10Marks Review Marks (3 reviews) : 30Marks Completion of Report work : 10Marks	End Semester Examination [Project Presentation and viva-voce]
Total: 50 Marks	Total: 50 Marks

Internship/Industrial visit/Field visit/Research Knowledge Updation Activity:

- A report should be submitted at the end of III semester and evaluated by external examiners.
- Students should submit certificate of attendance from the industry along with report.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)

Extension Activity :

- Outreach Activities / Conducting Virtual Presentations
 - Outreach Activities
 - Creating awareness of the usage of Computers in remote places
 - Performing any computer exhibition in a village
 - Conducting any type of awareness programmes using computers/ software
 - Conducting Virtual Presentations
 - Encourage the school students through some presentations
 - Conducting higher education awareness among school students using computers
- External examination will be conducted at the end of IV semester.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)

9. QUESTION PAPER PATTERN

External (End Semester) Examination Question Pattern

Time : 3 Hrs

Max.Marks: 75

Part – A (15x1 = 15 Marks)

Answer all the questions

Fifteen Questions, Three objective type questions from each unit.

[Two questions from K1 category

Two questions from K2 category
Two questions from K3 category
Three questions from K4 category
Three question from K5 category
Three question from K6 category]

Part – B (5x4 = 20 Marks)

Answer all the questions

Five Questions, two short answer type questions from each unit with internal choice (Either.. or .. type)

[Unit -I questions from K1 category
Unit -II questions from K2 or K3 category
Unit -III questions from K4 category
Unit -IV questions from K5 category
Unit-V questions from K6 category]

Part – C (5x8 = 40 Marks)

Answer all the questions

Five Questions, two descriptive type questions from each unit with internal choice (Either.. or .. type)

[Unit -I questions from K1 category
Unit -II questions from K2 or K3 category
Unit -III questions from K4 category
Unit -IV questions from K5 category
Unit-V questions from K6 category]

NOTE:

In both Internal and External (End Semester) Examinations

40% of the questions should be from the Lower Order Thinking (K1, K2 & K3) category

60% of the questions should be from the Higher Order Thinking (K4, K5 & K6) category

10.MODEL QUESTION PAPER

Course: Python Programming

Time: 3 Hours

Max. Marks: 75

PART – A (15 × 1 = 15 Marks)

Answer ALL the questions.

1. Which of the following is a valid identifier in Python? **(K1)**
 - a) 2_variable
 - b) var_2
 - c) var-2
 - d) break
2. What is the standard file extension used for Python modules? **(K1)**
 - a) .py
 - b) .pyc
 - c) .mod
 - d) .pyd
3. What does the type() function in Python return? **(K2)**
 - a) The value of the object
 - b) The memory address of the object
 - c) The data type class of the object
 - d) The size of the object
4. Which GUI widget is specifically designed to allow users to select only one option out of a predefined set? **(K2)**
 - a) Check Button
 - b) List Box
 - c) Entry
 - d) Radio Button
5. What is the output of the slice expression 'Python'[1:4]? **(K3)**
 - a) Pyth
 - b) yth
 - c) ytho
 - d) ythn
6. Consider a dictionary data = {'a': 1, 'b': 2}. Which method will completely empty this dictionary to leave it as {}? **(K3)**
 - a) data.remove()
 - b) data.pop()
 - c) data.clear()
 - d) data.delete()
7. Analyze the following code snippet and identify what it outputs: **(K4)**

```
def check(x=[]):  
    x.append(1)  
    return x  
print(check(), check())
```

- a) [1] [1]
 - b) [1] [1, 1]
 - c) [1, 1] [1, 1]
 - d) Error
8. Evaluate the cause of a `TypeError` exception in Python when handling class properties. Which scenario triggers it? **(K4)**
- a) Accessing an unassigned local variable
 - b) Attempting to concatenate a string with an integer
 - c) Importing a module that does not exist
 - d) Accessing a dictionary key that isn't present
9. Review the execution of the following MongoDB statement: `db.collection.delete_many({"status": "inactive"})`. What is the precise consequence if no documents match the criteria? **(K4)**
- a) The operation throws a critical runtime database exception
 - b) The entire collection is cleared as a safety fallback
 - c) The command executes successfully returning a deleted count of 0
 - d) The MongoDB server automatically restarts the collection session
10. Critique the design of a GUI application where a long-running computation is bound directly to a Tkinter Button command without threading. What is the primary architectural flaw? **(K5)**
- a) The button will automatically duplicate itself
 - b) The UI main loop freezes, making the interface completely unresponsive
 - c) The background computation will execute twice
 - d) Tkinter converts the application automatically into a web page
11. Deduce the primary performance benefit of implementing a Recursive function with a base case over a traditional loop for processing nested mathematical expressions. **(K5)**
- a) It consumes significantly less stack memory
 - b) It simplifies the tracking of state across deeply branch-dependent structures
 - c) It guarantees execution in $O(1)$ constant time complexity
 - d) It eliminates the need for any internal variable scope
12. Suppose you are assessing a MongoDB script designed to modify document traits. Assess which deployment strategy is ideal to update a single user's email without overwriting their entire profile record. **(K5)**
- a) `db.users.update_one({"id": 1}, {"email": "new@email.com"})`
 - b) `db.users.replace_one({"id": 1}, {"email": "new@email.com"})`
 - c) `db.users.update_one({"id": 1}, {"$set": {"email": "new@email.com"}})`
 - d) `db.users.insert_one({"email": "new@email.com"})`
13. Design a minimal Python statement structure using functional programming tools (filter and lambda) that constructs a new list containing only even values extracted from an initial list called `numbers`. **(K6)**
- a) `list(filter(lambda x: x % 2 == 0, numbers))`
 - b) `filter(lambda x: x / 2 == 0, numbers)`
 - c) `list(map(lambda x: x % 2 == 0, numbers))`
 - d) `[lambda x: x % 2 == 0 for x in numbers]`

14. Formulate the correct configuration code sequence to establish a functioning vertical Scrollbar attached perfectly to a Text widget layout in a Python GUI environment. **(K6)**
 - a) Bind scrollbar to text pack without cross-linking commands
 - b) Set text['yscrollcommand'] = scrollbar.set and scrollbar['command'] = text.yview
 - c) Set text['command'] = scrollbar.yview and scrollbar['yscrollcommand'] = text.set
 - d) Define both objects into separate frames without layout managers
15. Formulate a dynamic Python structure to generate custom instances of exceptions. How do you properly define a user-defined exception named ValueError? **(K6)**
 - a) class ValueError:
 - b) def ValueError(Exception):
 - c) class ValueError(Exception): pass
 - d) ValueError = new Exception()

PART – B (5 × 4 = 20 Marks)

Answer ALL the questions, choosing EITHER (a) OR (b).

16. a) Define Python identifiers. State the fundamental syntax rules used to name variables. **(K1)**
OR
b) Enumerate the built-in numeric data types supported in Python with clear examples for each. **(K1)**
17. a) Explain how formal arguments and variable-length arguments (*args and kwargs) are processed during a function call. **(K2)**
OR
b) Demonstrate the application of Python sets. Provide a small code snippet showing union, intersection, and difference operations. **(K3)**
18. a) Analyze the mechanism of namespaces in Python. Distinguish between local, global, and built-in namespaces when an import happens. **(K4)**
OR
b) Break down the handling of runtime anomalies using try, except, and finally blocks. Trace the flow when an exception arises. **(K4)**
19. a) Compare the UI design roles of a Frame widget versus a standalone layout container. Evaluate how nesting widgets in a frame optimizes application layouts. **(K5)**
OR
b) Assess the operational differences between using a Label widget and an Entry widget when validating direct alphanumeric user inputs. **(K5)**
20. a) Formulate a Python function that hooks up to a local MongoDB system, targets a collection, and executes an operation to alter matching attributes. **(K6)**
OR
b) Construct a custom Python script that performs a complete DELETE routine on a specific MongoDB target table/collection based on user inputs. **(K6)**

PART – C (5 × 8 = 40 Marks)
Answer ALL the questions, choosing EITHER (a) OR (b).

21. a) Write a comprehensive essay explaining standard type operators and built-in functions available for processing Python objects. **(K1)**
OR
b) Give a detailed account of structural control flow in Python. Describe conditional constructs and loop systems (for and while) with syntax and flowcharts. **(K1)**
22. a) Differentiate between mapping types (Dictionaries) and sequence types (Lists/Tuples). Explain their built-in operations, mutability factors, and internal storage features. **(K2)**
OR
b) Implement a complete, modular Python program that utilizes recursion to calculate the Fibonacci sequence up to N terms. Trace its execution stack for N=5. **(K3)**
23. a) Analyze the main pillars of Object-Oriented Programming (Encapsulation, Inheritance, and Polymorphism) within Python. Provide a clear code architecture illustrating these behaviors. **(K4)**
OR
b) Investigate the module import mechanism in Python. Analyze what happens internally when using import module versus from module import item, highlighting impacts on memory and names. **(K4)**
24. a) Critique the visual layout below. Appraise how to combine Menus, List Boxes, Buttons, and Scroll Bars to build an efficient, accessible user system. **(K5)**
OR
b) Appraise the utility of interactive selection tools (Check Buttons, Radio Buttons, and Scale sliders). Justify their placement configurations inside desktop database front-ends. **(K5)**
25. a) Devise a fully working Python program that establishes a live connection with a MongoDB instance, builds a collection, and runs sequential INSERT and READ CRUD workflows. **(K6)**
OR
b) Synthesize an end-to-end Python script that integrates a Tkinter Graphical User Interface with a backend MongoDB database to register new user profiles via input entries. **(K6)**

11.ENTIRE PROGRAMME STRUCTURE

FIRST YEAR

Semester-I

Specification	Courses	Credits	No. of Hours
Core – I	Mathematical Foundation for Information Technology	4	4
Core – II	Python Programming	4	4
Core – III	Java with Networking	4	4
Core – IV [LAB]	Python Programming – Practical	3	5
Core – V [LAB]	Java with Networking– Practical	3	5
Elective – I	Edge Computing / Mobile Commerce / Distributed and Cloud Computing	3	4
Elective – II	Data Communication & Networking / Block Chain Technology / Internet of Things and its Applications	3	4
		24	30

Semester-II

Specification	Courses	Credits	No. of Hours
Core – VI	Relational Database Management System	4	4
Core – VII	Data Structures and Algorithms	4	4
Core – VIII [LAB]	RDBMS - Practical	3	5
Core – IX [LAB]	Data Structures and Algorithms - Practical	3	5
Elective – III	Compiler Design / Intelligent Systems / Robotics and its Applications	3	4
Elective – IV	Software Project Management / Software Testing / Object Oriented Analysis and Design	3	4
Skill Enhancement Course – I	Reactive Native	3	4
		23	30

SECOND YEAR

Semester – III

Specification	Courses	Credits	No. of Hours
Core – X	Robotic Process Automation	4	4
Core – XI	Research Methodology	4	4
Core – XII	Wireless Communication	4	4
Core – XIII [LAB]	Robotics - Practical	3	5
Core – XIV [LAB]	Mini Project	3	5
Elective – V	Cryptography & Network Security / Big Data Analytics / Data Mining and Warehousing	3	4
Skill Enhancement Course – II	Artificial Neural Networks	3	4
	Internship	2	-
		26	30

Semester-IV

Specification	Courses	Credits	No. of Hours
Core – XV	Project with Viva Voce	16	30
	Extension Activity	1	-
		17	30

Total Credits : 90

Project : Individual Project report should be submitted at the end of IV semester for external evaluation. Internal – 50 Marks, External – 50 Marks (Total 100 Marks). The internal marks should be given based on the presentation of three reviews(0th review -10 Marks, 1st review – 10 Marks, 2nd review – 10 Marks) and the performance assessment of the guide (Project completion in time 10 Marks and Report 10 Marks).

12.COURSE – PSO MAPPING

Title of the course	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	Total score
Mathematical Foundation for Information Technology	1	3	3	1	0	2	1	11
Python Programming	1	3	2	2	0	3	1	12
Java with Networking	1	3	2	2	0	3	1	12
Python Programming – Practical	1	3	2	2	0	3	1	12
Java with Networking– Practical	1	3	2	2	0	3	1	12
Edge Computing	1	3	3	2	0	3	1	13
Mobile Commerce	2	3	2	2	3	3	1	16
Distributed and Cloud Computing	1	3	3	1	3	2	0	13
Data Communication & Networking	1	3	3	2	1	3	0	13
Block Chain Technology	1	3	3	2	3	3	1	16
Internet of Things and its Applications	1	3	2	1	1	3	0	11
Relational Database Management System	1	3	2	1	1	3	0	11
Data Structures and Algorithms	1	3	3	1	0	3	0	11
RDBMS - Practical	0	2	1	1	1	3	0	8
Data Structures and Algorithms - Practical	0	2	1	1	0	3	0	7
Compiler Design	1	3	3	1	0	3	0	11
Intelligent Systems	1	3	3	1	0	3	0	11
Robotics and its Applications	1	3	2	1	2	3	0	12
Software Project Management	2	3	2	2	2	3	3	17
Software Testing	1	3	2	2	1	3	2	14
Object Oriented Analysis and Design	1	3	2	1	0	3	1	11
Reactive Native	1	2	1	1	1	3	0	9
Robotic Process Automation	1	3	3	1	0	3	0	11
Research Methodology	2	3	3	2	3	3	0	16

Wireless Communication	1	3	2	1	1	3	0	11
Robotics - Practical	1	3	2	1	0	3	0	10
Mini Project	2	3	2	2	1	3	2	15
Cryptography & Network Security	1	3	3	1	2	3	0	13
Big Data Analytics	1	3	3	1	1	3	0	12
Data Mining and Warehousing	1	3	2	1	0	3	0	10
Artificial Neural Networks	1	3	3	1	1	3	0	12
Internship	2	3	2	3	2	3	3	18
Project with Viva Voce	3	3	3	3	2	3	3	20
Extension Activity	2	2	2	3	3	2	2	16
Total score of all courses contributing to PSO	40	98	79	52	35	99	24	427

Each Course has to address a minimum of 4 PSOs

Level of contribution of the Course towards attaining PSOs

0 – No Contribution

1 – Low Level

2 – Medium Level

3 – High Level

13.DETAILED SYLLABUS

Title of the Course	MATHEMATICAL FOUNDATION FOR INFORMATION TECHNOLOGY									
Category	CORE			Paper Number			CORE I			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	4	4	25	75	100
Course Outline	UNIT I : MATRIX ALGEBRA Matrices - Rank of a matrix - Solving system of equations - Eigenvalues and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.									
	UNIT II : BASIC SET THEORY Basic definitions - Venn diagrams and set operations - Laws of set theory -. Relations - Properties of relations - Matrices of relations - Closure operations on relations - Functions - Injective, subjective and objective functions-Hermitian and Unitary operators/matrices.									
	UNIT – III : COMBINATORICS Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion									
	UNIT IV : MATHEMATICAL LOGIC Propositions and logical operators -Truth table - Propositions generated by a set - Equivalence and implication -Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus – Predicate calculus									
	UNIT V : GRAPH THEORY: Graphs: An Introduction, Special Graphs, Subgraph, Degree of a Vertex – The Concept, Given a Degree Sequence –How to Draw the Graph? Adjacency Matrices, Incidence Matrices, Isomorphism of Graphs, Paths and Circuits, Euler Paths, Hamiltonian Circuit, the Travelling Salesman Problem, Shortest Path Problem									
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB /NET / UGC – CSIR / GATE / TNPSC/others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)									
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill									
Recommended Text	1. J.P Trembley, R. Manohar, “Discrete Mathematical structures with applications to Computer Science”, Tata McGrawHill publications, 2017 2. Seymour Lipschutz, Marc Lipson, “Discrete Mathematics”, Revised Third Edition, Schaum’s Outline Series, Tata McGraw Hill Publications, 2002. 3. John Vince, “Foundation Mathematics for Computer Science, A Visual Approach”, Springer, 2015. 4. Jayant Ganguly, “Mathematical Foundations for Computer Science Engineers”, PHI, 2011									

Reference Books	1. K. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley, 2016. 2. M. Mitzenmacher and E. Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005. 3. Alan Tucker, "Applied Combinatorics", 6th Edition, Wiley 2012.
Website and e-Learning Source	https://nptel.ac.in/courses/106/106/106106183/ https://nptel.ac.in/courses/111/105/111105035/ https://nptel.ac.in/courses/111/102/111102133/ https://nptel.ac.in/courses/106/103/106103015/

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and Explain: Define matrix rank, Cayley-Hamilton theorem, basic set operations, types of functions, Pigeon hole principle, propositional connectives, and basic graph definitions (degrees, subgraphs).
CO2	K3	Apply: Compute the inverse of a matrix, solve system of equations, find closures of relations, apply Mathematical Induction and the Principle of Inclusion-Exclusion, and construct truth tables.
CO3	K4	Analyze: Determine eigenvalues/eigenvectors, analyze whether matrices are Hermitian/Unitary, simplify logical statements using normal forms, and analyze graphs for Euler/Hamiltonian circuits and isomorphism.
CO4	K5 & K6	Evaluate & Create: Evaluate and formulate solutions for complex networking/routing scenarios using the Shortest Path and Travelling Salesman algorithms, and assess the validity of proofs in predicate calculus.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	1	1	1	1
CO2	2	2	3	2	1	2	1
CO3	2	3	2	2	1	2	1
CO4	3	3	3	3	2	2	2
Total Score	9	9	9	8	5	7	5

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	2	1
CO2	2	3	3	2	1	2	2
CO3	2	3	3	2	1	3	2
CO4	3	3	3	2	1	3	3
Total Score	9	11	12	8	4	10	8

Title of the Course	PYTHON PROGRAMMING									
Category	CORE			Paper Number			CORE II			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	4	4	25	75	100
Course Outline	UNIT-I : Core Python: Introduction - Python Basics: Comments -Statements and syntax - variable Assignment - Identifiers - Python objects : Built-in-types - Internal types - Standard Type operators - Standard type Built-in-functions. Numbers : Introduction to Numbers - Integers - Floating point numbers - Complex numbers - Operators - Built-in and factory functions –Conditionals and Loops - Sequences : Strings, Lists and Tuples									
	UNIT-II : Mapping and set types.- Functions and functional programming: Introduction - Calling functions - Creating functions - passing functions - Formal arguments - Variable - Length Arguments - Functional Programming - Variable Scope – Recursion									
	UNIT-III : Modules: Modules and Files – name spaces - Importing Modules - Features - Built-in functions. Object Oriented Programming: Introduction - Object Oriented Programming – Encapsulation - Inheritance –Polymorphism - Errors and Exceptions: Introduction – Exceptions in Python.									
	UNIT-IV : GUI Programming: Introduction – Using Widgets: Core widgets- Generic widget properties – Labels – Buttons – Radio Buttons – Check Buttons – Text – Entry – List Boxes – Menus –Frame – Scroll Bars – Scale									
	UNIT-V: Database Programming: Connecting to a database using MongoDB - Creating Tables - INSERT-UPDATE - DELETE - READ operations.									
Reference Books	1. Mark Lutz, (2013), “Learning Python Powerful Object Oriented Programming”, O’reillyMedia, 5 th Edition. 2. Timothy A. Budd, (2011), “Exploring Python”, Tata MCGraw Hill Education PrivateLimited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), “How to think like a computerscientist: learning with Python”									
Website and e-Learning Source	1. http://interactivepython.org/courselib/static/pythonds 2. http://www.ibiblio.org/g2swap/byteofpython/read/ 3. http://www.diveintopython3.net/ 4. http://docs.python.org/3/tutorial/index.html									

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and Explain: Understand Python variables, numbers, strings, lists, tuples, dictionaries, set types, module namespaces, OOP concepts, core Tkinter/GUI widgets, and MongoDB connection basics.
CO2	K3	Apply: Implement flow control (loops and conditionals), pass variable-length arguments to functions, deploy recursive

		techniques, import/create modules, and build simple interfaces with buttons and labels.
CO3	K4	Analyze: Differentiate structural components of an OOP application, analyze scope chains, and diagnose/handle runtime errors using try-except blocks.
CO4	K5 & K6	Evaluate & Create: Appraise factory functions, build complex data structures, and create multi-layered database applications capable of full CRUD (Create, Read, Update, Delete) execution via a GUI.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	2	1	1	2
CO4	3	3	3	3	2	3	3
Total Score	10	9	9	9	5	8	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	1	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	5	12	8

Title of the Course			JAVA WITH NETWORKING							
Category		CORE		Paper Number			CORE III			
Course Code							Inst.	Marks		
	L	T	P	Year	Semester	Credits	Hours	CIA	External	Total
	4	0	0	I	I	4	4	25	75	100
Course Outline		UNIT-I : The Genesis of Java: Java's Magic, The Java Buzzwords-An Overview of Java - Data types, Variables, Arrays-Operators-Control Statements- Introducing Classes – A Close Look at Methods and Classes-Inheritance								
		UNIT-II : String Handling Functions – Collections Framework: Collection Classes, String Tokenzier, Date, Calendar - Abstract Classes - Packages and Interfaces: Packages – Access Protection Importing Packages – Interfaces								

	UNIT-III : Exception Handling: Exception types – Creating your own exceptions -Multithreaded Programming: Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication, Suspending, Resuming and Stopping Threads – JDBC
	UNIT-IV : The Applet Class-Event Handling – Introducing the AWT: Working with windows, graphics and Text, Using AWT Controls, Layout Managers and Controls - Developing Java Server Pages
	UNIT-V: Developing Servlets -Structuring Web application with the MVC pattern – Sessions and Cookies - Using JSP tags with JavaBeans
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Herbert Schildt, (2004), “Java 2: The Complete Reference”, Fifth Edition,Tata McGraw Hill,New Delhi. 2. Joel Murach, (2008), “Andrea Steelman,,Murach”s Java Servlets and JSP”, Second Edition,Shroff Publishers
Reference Books	1. Matthew Mac Donald, (2002), “ASP.NET: The Complete Reference”, MC Graw Hill. 1. VladaMatena, (2003), “Applying Enterprise JavaBeans”, Second Edition, Addison Wesley. 2. Cay S Horstmann& Gary Cornell, Core Java Vol II Advanced Features, Eighth Edition,Addison Wesley. 3. Bruce W Perry (2004), Java Servlets & JSP Cook Book, Second edition, O’reilly Media.
Website and e-Learning Source	1. http://netbeans.org/kb/docs/javaee/javaee-intro.html 2. http://www.jsptube.com/ 3. http://articles.sitepoint.com/article/java-servlets-1 4. http://www.java-tips.org/java-tutorials/tutorials/introduction-to-java-servlets-with-netbeans.html 5. http://download.oracle.com/javase/tutorial/javabeans/index.html 6. http://www.javapoint.com/steps-to-connect-to-the-datadase-in-java/ (Unit III: JDBC)

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and Explain: Detail the Java buzzwords, class structures, standard collection frameworks, string handling structures, Thread attributes, Applet/AWT controls, and fundamental servlet lifecycle methods.
CO2	K3	Apply: Build simple application workflows using primitive operators, encapsulate modular functionality via packages/interfaces, write custom exception try-catch blocks, and position GUI elements using layout managers.
CO3	K4	Analyze: Deconstruct complex code relationships utilizing hierarchical abstract inheritance, test multi-threaded code paths for proper synchronization, and trace state transfers between client-side cookies and server-side sessions.
CO4	K5 & K6	Evaluate & Create: Assemble interactive web-based software architectures adhering to Model-View-Controller patterns that fetch relational database content utilizing Java Database Connectivity.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	1	1	2	1
CO2	2	2	2	2	1	2	1
CO3	2	3	2	2	1	2	1
CO4	3	3	3	3	2	3	2
Total Score	9	9	8	8	5	9	5

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course				PYTHON PROGRAMMING - PRACTICAL						
Category		CORE		Paper Number			CORE IV			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	5	I	I	3	5	50	50	100

Course Outline	1. Python Basic programs 2. Control Structures 3. Lists 4. Functions and Recursions 5. Modules 6. String Processing 7. Dictionaries and Sets 8. Classes and Objects 9. Polymorphism 10. Inheritance 11. GUI Application 12. Working with Database
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Wesley J. Chun, (2007), “Core Python Programming”, Pearson Education, Second Edition –
Reference Books	1. Mark Lutz, (2013), “Learning Python Powerful Object Oriented Programming”, O’reillyMedia, 5 th Edition. 2. Timothy A. Budd, (2011), “Exploring Python”, Tata McGraw Hill Education PrivateLimited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), “How to think like a computerscientist: learning with Python”
Website and e-Learning Source	1. http://interactivepython.org/courselib/static/pythonds 2. http://www.ibiblio.org/g2swap/byteofpython/read/ 3. http://www.diveintopython3.net 4. http://docs.python.org/3/tutorial/index.html

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain fundamental Python concepts, including basic programming syntax, control structures, collection types (lists, dictionaries, sets), functions, modules, string processing, and the core tenets of object-oriented programming.
CO2	K3	Apply Python programming constructs to develop modular scripts, utilizing iterative structures, recursive functions, custom modules, and sequence manipulation techniques to solve computational problems.
CO3	K4	Analyze and deconstruct complex software requirements to design structured object-oriented solutions implementing class hierarchies, inheritance, and polymorphic relationships.

CO4	K5 & K6	Evaluate program execution pathways and create full-stack desktop software architectures by integrating interactive Graphical User Interfaces (GUIs) with robust database connectivity.
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	2	1	2	1
CO2	2	2	2	2	1	2	2
CO3	3	3	2	2	1	2	2
CO4	3	3	3	3	2	3	3
Total Score	10	9	8	9	5	9	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	1	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	10	8	5	11	8

Title of the Course		JAVA WITH NETWORKING – PRACTICAL								
Category		CORE			Paper Number			CORE V		
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	5	I	I	3	5	50	50	100
Course Outline		1. Write a program to create a JTable. 2. Convert an image in RGB to a grayscale image. 3. Count number of access times of the servlet page. 4. Write a program to display a string in frame window with pink color as background. 5. Create chat application using either TCP or UDP protocol. 6. Implement TCP Server for transferring files using Socket and Server Socket. 7. Implement Student information system using JDBC and RMI. 8. Create Servlet file and study web descriptor file. 9. Write a program to design simple calculator with the use of Grid Layout. 10. Create login form and perform state management using Cookies, HTTP Session and URL Rewriting. 11. Write an Applet which will lay two sound notes in a sequence continuously use the play () methods available in the applet class and the methods in the audio clip interface. 12. Write a program to demonstrate the use of InetAddress class and its factor methods. 13. Create Servlet file which contains following functions: 1. Connect 2. Create Database 3. Create Table 4. Insert Records into respective tables 5. Update records of particular table in database 6. Delete Records from table. 7. Delete table and also database 14. Develop Simple Servlet Question Answer Application using Database 15. Develop simple shopping cart application using EJB [Stateful Session Bean].								
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved								
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill								
Recommended Text		Java the Complete Reference, ninth edition by Herbert Schild, Publisher: McGraw Hills								

Reference Books	1. Head First EJB 3.0 by Kathy Sierra, Bert Bates, Publisher: O'Reilly Media 2. Head First Servlets and JSP by Bryan Basham, Kathy Sierra & Bert Bates, Publisher: O'Reilly Media 3. Just Hibernate, A Lightweight Introduction to the Hibernate Framework by Madhusudhan Konda, Publisher: O'Reilly Media 4. Programming Jakarta Struts, 2nd Edition by Chuck Cavaness, Publisher: O'Reilly Media
Website and e-Learning Source	https://nptel.ac.in/courses/106/105/106105191/ https://onlinecourses.nptel.ac.in/noc19_cs84/preview

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the architecture of Java web components, servlet lifecycle methods, deployment descriptors, network programming concepts (TCP/UDP, InetAddress), RMI registry, AWT/Swing GUI hierarchies, and Enterprise JavaBeans (EJB) structures.
CO2	K3	Apply Java networking, GUI, and web APIs to build applications, including configuring layout managers, rendering images in grayscale, invoking audio playback, performing basic socket communication, and managing database connections.
CO3	K4	Analyze execution workflows and data transmission pathways to trace state management techniques (Cookies, HTTP Session, URL Rewriting), track page hit metrics, deconstruct RMI middleware configurations, and examine TCP file transfer protocols.
CO4	K5 & K6	Evaluate multi-tier architectures and create full-featured, secure enterprise applications such as desktop chat engines, question-answer engines, student information systems, and transactional shopping carts using JDBC, Servlets, and Stateful Session EJBs.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	2	1	2	1
CO2	2	2	2	2	1	2	2
CO3	3	3	2	2	1	2	2
CO4	3	3	3	3	2	3	3
Total Score	10	9	8	9	5	9	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2

CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		EDGE COMPUTING								
Category		Elective		Paper Number			ELECTIVE I A			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT I INTRODUCTION Introduction to Cloud and its limitations to support low latency and RTT – From Cloud to Edge computing: Waves of innovation –Introduction to Edge Computing Architectures								
		UNIT II DISTRIBUTED SYSTEMS IN EDGE COMPUTING Edge Computing to support User Applications (5G-Slicing, self-driving cars and more) – Concepts of distributed systems in edge computing such as time ordering and clock synchronization, distributed snapshot, etc								
		UNIT III EDGE CLOUD SERVICES Introduction to Edge Data Center – Lightweight Edge Clouds and its services provided by different service providers – Introduction to docker container – Kubernetes in edge computing – Design of edge storage systems like key -value stores								
		UNIT IV MQTT AND KAFKA Introduction to MQTT and Kafka for end-to-end edge pipeline – Edge analytics topologies for M2M and WSN network (MQTT)								
		UNIT V EDGE SENSOR DATA IN MACHINE LEARNING Use cases of machine learning for edge sensor data in predictive maintenance, image classifier and self-driving cars – Deep Learning On-Device inference at the edge to support latency-based application								
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)								
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill								

Recommended Text	Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, First Edition, Wiley, 2019
Reference Books	1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2011. 2. Rajiv Misra, Yashwant Patel, “Cloud and Distributed Computing: Algorithms and Systems”, First Edition, Wiley, 2020
Website and e-Learning Source	1. https://onlinecourses.nptel.ac.in/noc24_cs66/preview (NPTEL Online Course videos by Dr. Rajiv Misra, IIT, Patna) 2. https://www.frontiersin.org/articles/10.3389/fenrg.2022.850252/full

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Describe and explain edge computing architectures, distributed system concepts, edge cloud services, messaging pipelines, and edge ML use cases.
CO2	K3	Apply distributed system concepts, containerization tools, and messaging protocols to edge computing scenarios.
CO3	K4	Analyze edge data center designs, communication topologies, storage mechanisms, and deep learning inference performance for low-latency applications.
CO4	K5 & K6	Evaluate and design end-to-end edge analytics pipelines, storage solutions, and machine learning deployment strategies for real-world applications like 5G and self-driving cars.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	2	1
CO2	2	2	3	2	1	3	2
CO3	2	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	10	10	10	5	11	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	2	1	3	2
CO2	3	3	2	2	1	3	3
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	3	3	3

Total Score	11	11	10	8	7	12	10
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Title of the Course		MOBILE COMMERCE								
Category		Elective		Paper Number			ELECTIVE I B			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT-1 ELECTRONIC COMMERCE								
		Introduction - The e-commerce environment - The e-commerce marketplace - Focus on portals - Location of trading in the marketplace - Commercial arrangement for transactions - Focus on auctions - Business models for e-commerce - Revenue models - Focus on internet start, up companies the dot, com, E-commerce versus E-business.								
		UNIT-2 MOBILE COMMERCE								
		Infrastructure of M-Commerce - Types of Mobile Commerce Services - Technologies Of Wireless Business - Benefits and Limitations, Support - Mobile Marketing & Advertisement - Non-Internet Applications In M-Commerce - Wireless/Wired Commerce Comparisons								
		UNIT-3 MOBILE COMMERCE, TECHNOLOGY								
		A Framework for the Study of Mobile Commerce, NTT DoCoMo's I, Mode, Wireless Devices for Mobile Commerce - Towards a Classification Framework for Mobile Location Based Services - Wireless Personal and Local Area Networks - The Impact of Technology Advances on Strategy Formulation in Mobile Communications Networks								
		UNIT-4 MOBILE COMMERCE, APPLICATIONS								
		Theory And Applications: The Ecology of Mobile Commerce - The Wireless Application Protocol, Mobile Business Services, Mobile Portal - Factors Influencing the Adoption of Mobile Gaming Services - Mobile Data Technologies And Small Business Adoption And Diffusion. M-Commerce in The Automotive Industry, Location, Based Services: Criteria For Adoption And Solution Deployment - The Role Of Mobile Advertising In Building A Brand - M-Commerce Business Models								
		UNIT-5 BUSINESS-TO-BUSINESS MOBILE E-COMMERCE								
		Enterprise Enablement, Email and Messaging - Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare) - Field Sales Support (Content Access, Inventory) - Asset Tracking And Maintenance/Management - Remote IT Support - Customer Retention (B2C Services, Financial, Special Deals) - Warehouse Automation - Security								

Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Get the knowledge of Mobile commerce usage and its applications
Recommended Text	Brian E. Mennecke, Troy J. Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IIR press, 2003
Reference Texts	1. P. J. Louis, “M – Commerce Crash Course”, McGraw – Hill Companies February 2001. 2. Paul May, “Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business” Cambridge University Press March 2001

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Describe and explain the foundational concepts of e-commerce and m-commerce ecosystems, including marketplace environments, wireless technologies, mobile applications, and enterprise security frameworks.
CO2	K3	Apply e-commerce revenue models, wireless communication technologies, mobile protocols, and location-based frameworks to real-world business and operational workflows.
CO3	K4	Analyze the strategic impact of technological advancements, user adoption factors, network topologies, and structural differences between wired, mobile, and B2B digital commerce systems.
CO4	K5 & K6	Evaluate and design integrated mobile commerce business models, secure enterprise enablement strategies, field automation pipelines, and targeted digital marketing campaigns for diverse industrial applications.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	2	1
CO2	2	2	3	2	1	3	2
CO3	2	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	10	10	10	5	11	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	2	2	3	2
CO2	3	3	2	2	2	3	3
CO3	2	3	3	3	2	3	2

CO4	3	3	3	2	3	3	3
Total Score	11	11	10	9	9	12	10

Title of the Course		Distributed and Cloud Computing								
Category		Elective		Paper Number			ELECTIVE I C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT-I : Distributed Communication Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – Request-Reply Protocols – Remote Procedure Call –Remote Method Invocation – Group Communication – Coordination in Group Communication– Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.								
		UNIT-II : Distributed Resource Management Global States– Distributed Mutual Exclusion – Election Algorithms – Distributed Deadlock – Distributed File System Architecture – HDFS – Map Reduce.								
		UNIT-III : Introduction to Cloud Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service , Broad network access , Location independent resource pooling , Rapid elasticity , Measured service. Architectural influences – High- performance Computing, Utility and Enterprise Grid Computing, Autonomic Computing, Service Consolidation, Horizontal scaling, Web services, High scalability Architecture. Cloud Benefits – Cloud Deployment Model: Public Clouds – Private Clouds – Community Clouds - Hybrid Clouds - Advantages of Cloud Computing.								
		UNIT-IV : Virtualization Techniques Introduction to Virtual Machines, Emulation :Interpretation and Binary Translation, Process Virtual machines and System Virtual machines Virtualization : Virtualization and cloud computing - Need of virtualization – limitations – Types of Hardware Virtualization: Full Virtualization – Para Virtualization – Case Studies : Xen,VMware – Desktop Virtualization – Network Virtualization.								

	UNIT-V: Cloud Resources Management And Issues Cloud architecture: Cloud delivery model, Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platform – Benefits – Operational benefits - Economic benefits – Evaluating SaaS – Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rack-space – Force.com – Services and Benefits – Infrastructure-as-a -Service (IaaS): IaaS Service Providers – Amazon EC2 – GoGrid.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.
Reference Texts	1. Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, Second Edition, Pearson Prentice Hall, 2006. 2. MukeshSinghal, Advanced Concepts In Operating Systems, McGraw Hill Series in Computer Science, 1994. 3. Cloud Computing A Practical Approach - Anthony T. Velte, Toby J. Velte, Robert Elsenpeter Tata-McGraw- Hill , New Delhi – 2010.
Website and e-Learning Source	https://nptel.ac.in/courses/106/104/106104182/ https://onlinecourses.nptel.ac.in/noc21_cs15/preview

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Describe and explain the fundamentals of distributed systems, resource management techniques, cloud computing paradigms, virtualization types, and cloud delivery models.
CO2	K3	Apply communication protocols, synchronization algorithms, MapReduce frameworks, and virtualization techniques to configure and manage distributed and cloud environments
CO3	K4	Analyze the behavior of distributed coordination algorithms, architectural influences on cloud computing, hardware virtualization limits, and performance profiles of different cloud storage architectures.
CO4	K5 & K6	Evaluate and design scalable distributed systems, resource management strategies, deployment models, and optimized cloud services configurations (SaaS/PaaS/IaaS) for complex computational needs.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	2	1
CO2	2	2	3	2	1	3	2
CO3	2	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	10	10	10	5	11	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	3	2	1	3	2
CO2	3	3	3	2	1	3	3
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	3	3	3
Total Score	11	11	12	8	7	12	10

Title of the Course		DATA COMMUNICATION AND NETWORKING								
Category		Elective		Paper Number			ELECTIVE II A			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT-I : Uses of Computer Networks – Network Hardware – Line Configuration – Topology – Transmission Modes – Reference Models: OSI Reference Model – TCP/IP Reference Model – Physical Layer: Guided Transmission Media – Wireless Transmission – Communication Satellites – Public Switched Telephone Network: Local Loop – Multiplexing – Switching								
		UNIT-II ; Data Link Layer: Design Issues - Error Detection and Correction - Network Layer : Design Issues – Routing Algorithms : Shortest Path Routing – Distance Vector Routing – Link State Routing – Broadcast Routing – Multicast Routing – Congestion Control								
		UNIT-III : Network Layer in the Internet: IP Addresses – Transport Layer: Elements of Transport Protocols: Addressing – Connection Establishment – Connection Release – Application Layer: Domain Name System –								

	Email: Architecture and Services
	UNIT-IV : Network Security: Introduction to Cryptography - Symmetric - Key Cryptography - Asymmetric- key Cryptography – Security Services: Message Confidentiality - Message Integrity – Message Authentication - Digital Signature - Entity Authentication – Security in the Internet: IPSecurity - SSL/TLS: SSL services - SSL Protocols - Firewalls
	UNIT-V: Security for Wireless Networks: Introduction – Protecting the wireless networks – Physical Security – Authentication and access control- Smartphone Security: Security Threats - Steps to smartphone security –Websites and Web application Security: Definition – Available Technologies - Threats – Strategies. Case Study: To study recent Wi -Fi and Smartphone technologies
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Andrew S.Tanenbaum, David J. Wetherall (2010), Computer Networks, Prentice Hall of India, V Edition. (Unit I - Unit - III) Unit I – Chapter 1,2 Unit II – Chapter 3,5 Unit III – Chapter 5,6,7 2. Behrouz A. Forouzan, (2016), Data Communications and Networking, Tata McGraw-Hill Publishing Company Limited, IV Edition. (Unit IV) Unit IV - Chapter 30, 31, 32
Reference Books	1. Charles P.Shari Lawrence P fleeger, Security in Computing, 3 rd Edition, Pearson Education. 2. James F. Kurose, Keith W Ross (2005), Computer Networking, 3 rd Edition, Addison Wesley.. 3. William Stallings(2006), Cryptography and Network Security: Principles and Practice, 3rd Edition, PHI.

Website and e-Learning Source	1. http://wndw.net/pdf/wndw3-en/ch09-security-for-wireless-networks.pdf (Unit V- Wireless Networks Security) 2. https://www.fcc.gov/sites/default/files/smartphone_master_document.pdf (Unit V- Steps to smartphone security) 3. https://www.csoonline.com/article/3241727/mobile-security/6-mobile-security-threats-you-should-take-seriously-in-2019.html (Unit V – SmartPhone Security Threats) 4. https://kgk.uni-obuda.hu/sites/default/files/12_Kadena.pdf (Unit V – SmartPhone Security Threats) 5. https://www.goodfirms.co/glossary/web-security/ (Unit V – Web Security)
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CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of computer networks, including network hardware, transmission media, network topologies, OSI and TCP/IP reference models, switching techniques, and basic cryptographic concepts.
CO2	K3	Apply networking concepts and protocols to configure routing techniques, error detection and correction methods, transport layer operations, DNS services, email architecture, and wireless network protection mechanisms.
CO3	K4	Analyze network layer operations, routing algorithms, congestion control methods, transport protocols, authentication mechanisms, SSL/TLS protocols, firewall operations, and security threats in wireless and web applications.
CO4	K5 & K6	Evaluate network security architectures and create secure communication solutions by integrating cryptographic techniques, IP security services, wireless security strategies, smartphone security practices, and modern web application protection mechanisms.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	2	1	2	1
CO4	3	3	3	3	2	2	2
Total Score	10	9	9	9	5	8	6

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	2	2	1	3	2

CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	12	11	8	6	12	9

Title of the Course		BLOCK CHAIN TECHNOLOGY								
Category		Elective		Paper Number			ELECTIVE II B			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT - I History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, Signature- Hash chain to Block chain-Basic consensus mechanisms.								
		UNIT - II Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.								
		UNIT – III Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.								
		UNIT – IV Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, - Capital markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting								
		UNIT - V Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain								
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)								
Skills acquired from this course		Get the ideas to test the different software								

Recommended Text	1. Mark Gates, “<i>Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money</i>”, Wise Fox Publishing and Mark Gates 2017. 2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, “<i>Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer</i>”, 2018. 3. Bahga, Vijay Madiseti, “<i>Block chain Applications: A Hands-On Approach</i>”, Arshdeep Bahga, Vijay Madiseti publishers 2017.
Reference Texts	1. Andreas Antonopoulos, “<i>Mastering Bitcoin: Unlocking Digital Crypto currencies</i>”, O'Reilly Media, Inc. 2014. 2. Melanie Swa, “<i>Block chain</i>”, O'Reilly Media 2014.
Web References	1. NPTEL & MOOC courses titled blockchain technology 2. blockgeeks.com/guide/what-is-block-chain-technology https://nptel.ac.in/courses/106105184/

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of blockchain technology, including distributed ledgers, blockchain architecture, cryptographic primitives, consensus mechanisms, permission models, privacy concepts, and Hyperledger Fabric components.
CO2	K3	Apply blockchain concepts and consensus protocols to implement Proof of Work mechanisms, permissioned blockchain models, chaincode development, Hyperledger Fabric SDK integration, and blockchain-based application workflows.
CO3	K4	Analyze the scalability, security, and consensus processes of blockchain systems, including decomposition of consensus mechanisms, permissioned blockchain protocols, smart contract implementation, and blockchain applications in finance and supply chain management.
CO4	K5 & K6	Evaluate blockchain-based solutions and create secure decentralized applications for government, financial, and supply chain systems by integrating cryptographic security, privacy mechanisms, digital identity management, and distributed record-keeping frameworks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	2	1	2	1
CO4	3	3	3	3	2	2	2
Total Score	10	9	9	9	5	8	6

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
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CO1	2	2	3	2	1	3	2
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	3	3	3
Total Score	9	11	12	8	7	12	9

Title of the Course		INTERNET OF THINGS AND ITS APPLICATIONS								
Category		Elective		Paper Number			ELECTIVE II C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Course Outline		UNIT-I : Introduction to IoT - Introduction to Internet of Things: Introduction-Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates								
		UNIT-II : Domain Specific IoT: Introduction-Home Automation-Cities-Environment-Energy-Retail- Logistics-Agriculture-Industry-Health & Lifestyle. IoT and M2M: Introduction - M2M- Difference between IoT and M2M - SDN and NFV for IoT.								
		UNIT-III : M2M to IoT- An Architectural Overview: Building an Architecture-Main design principles and needed capabilities-An IoT Architecture Outline-Standard Considerations. M2M and IoT Technology Fundamentals: Devices and Gateways-Local and wide area Networking-Data Management.								
		UNIT-IV : IoT Architecture - Architecture Reference Model: Introduction-Reference Model and Architecture- IoT Reference Model: IoT Domain Model-Information Model-Functional Model- Communication Model-Safety, Privacy, Trust, Security Model IoT.								
		UNIT-V: Implementation Examples: The Smart Grid-Introduction-Smart Metering-Smart House-Smart energy city. Case Study: Commercial Building automation today and in the future.								

Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015 (Unit I and II) 2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014 (Unit III, IV and V).
Reference Books	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
Website and e-Learning Source	1. https://www.tutorialspoint.com/internet_of_things/ 2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/ 3. https://www.slideshare.net/khusuma/domain-specific-iot(Unit-II) 4. https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies(Unit-III) 5. https://www.smartgrid.gov/the_smart_grid/smart_grid.html

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of Internet of Things (IoT), including IoT architecture, physical and logical design, enabling technologies, deployment models, M2M communication concepts, and IoT reference models.
CO2	K3	Apply IoT and M2M technologies to develop domain-specific IoT applications in areas such as home automation, smart cities, healthcare, agriculture, retail, logistics, and industrial systems using networking and data management techniques.

CO3	K4	Analyze IoT architectures, communication models, networking frameworks, gateways, security mechanisms, and data management processes to evaluate interoperability, scalability, and system integration requirements in IoT environments.
CO4	K5 & K6	Evaluate IoT solutions and create smart interconnected systems for energy management, smart metering, smart homes, smart cities, and commercial building automation by integrating IoT architectures, security models, and communication technologies.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	3	1	3	2
CO3	2	3	3	2	1	2	1
CO4	3	3	3	3	2	3	3
Total Score	10	9	10	10	5	10	7

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		RELATIONAL DATABASE MANAGEMENT SYSTEM								
Category		CORE		Paper Number			CORE VI			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	4	4	25	75	100
Course Outline		UNIT-I : Introduction: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. Relational Database: Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams- Formal Relational Query Languages: Relational Algebra-Tuple Relational Calculus								

	UNIT-II : Database Design: Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas - Extended E-R features -Alternative Notations for Modeling Data. Relational Database Design: Features of Good Relational Design-Functional Dependency-Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF- Functional Dependency Theory UNIT-III : Transaction Management: Transaction Concept-Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation - Serializability. Concurrency Control: Lock Based Protocols-Locks-Granting of Locks-Two Phase Locking Protocol-Time Stamp Based Protocol - Recovery System: Failure Classification-Recovery and Atomicity: Log Records – Database Modification-Concurrency Control and Recovery-Recovery Algorithm UNIT-IV : Distributed Database: Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases- Distributed Query Processing. Case study: MongoDB UNIT-V: SQL - Table Fundamentals - Viewing Data - Inserting -Deleting - Updating - Modifying - Constraints - Functions – Grouping - Subqueries - Joins – Views. PL/SQL: Introduction - PL/SQL Block -Data Types And Variables - Control Structure -Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling-Packages - Procedures and Functions - Database Triggers
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamental concepts of database systems, relational databases, database design principles, transaction management, distributed databases, SQL, and PL/SQL structures and commands.
CO2	K3	Apply relational database concepts, normalization techniques, transaction management, distributed database operations, and SQL/PL/SQL commands to solve database-related problems.
CO3	K4	Analyze database design models, functional dependencies, normalization processes, concurrency control mechanisms, recovery techniques, distributed database architectures, and SQL query structures for efficient database implementation.

CO4	K5 & K6	Evaluate and design database solutions using advanced normalization, transaction processing, distributed database techniques, SQL/PL/SQL programming, procedures, functions, triggers, and security mechanisms for real-world applications.
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	9	9	10	5	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	3	3	3
Total Score	9	11	11	8	7	12	8

Title of the Course		DATA STRUCTURES AND ALGORITHMS								
Category		CORE		Paper Number			CORE VII			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	4	4	25	75	100
Course Outline		UNIT-I : Primary Data Structures, Time and Space Complexity Analysis Sorting – Quick and Heap Sort, Radix Sort, AVL trees, Graph Traversals Asymptotic notations, conditional asymptotic notations, Amortized analysis, NP complete and NP hard Time and Space complexity analysis by solving recurrence equations								
		UNIT-II : Optimization Data structures Search Trees, building Optimal search trees, Height balanced and Weight balanced trees B –trees, Red Black Trees and Splay trees								

	UNIT-III : Data Structures for sets of Intervals Interval Trees - Segment Trees, Trees for Weighted Intervals, Higher dimensional Segment Trees. Range Counting and Semi group model. K-d trees, Orthogonal Range trees, Leftist heap, Skew heap, Binomial heap and Fibonacci heaps.
	UNIT-IV : Data structures for Strings & Transformations Dynamic Structures, Persistent Structures, Tries, Compressed Tries, Suffix Trees and Suffix Arrays
	UNIT-V: Advanced Algorithm Design Dynamic Programming - Rod Cutting, Matrix chain multiplication, Longest Common Subsequence .Greedy Algorithms – Activity selection problem, Matroids and Greedy methods

Extended	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC/ others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms: Third Edition”, The MIT Press, 2014.
Reference Books	1. Thomas H.Cormen, “Algorithms Unlocked”, The MIT Press, 2013 2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2014
Website and e-Learning Source	https://goalkicker.com/AlgorithmsBook/ https://nptel.ac.in/courses/106/102/106102064/ https://nptel.ac.in/courses/106/102/106102064/ .

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain advanced data structures and algorithmic concepts, including complexity analysis, asymptotic notations, sorting techniques, graph traversals, balanced trees, heaps, interval trees, tries, suffix structures, and dynamic programming principles.
CO2	K3	Apply advanced data structures and algorithm design techniques to solve computational problems using balanced trees, heaps, interval structures, string processing methods, greedy algorithms, and dynamic programming approaches.
CO3	K4	Analyze the efficiency and performance of advanced algorithms and data structures through recurrence relations, amortized analysis, NP-completeness concepts, optimization techniques, and range-query processing methods.

CO4	K5 & K6	Evaluate algorithmic strategies and create optimized computational solutions using advanced tree structures, persistent data structures, dynamic programming models, and greedy methods for complex problem-solving applications.
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	12	8	6	12	8

Title of the Course		RDBMS PRACTICAL								
Category		CORE			Paper Number			CORE VIII		
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	5	I	II	3	5	50	50	100

Course Outline	- DDL Commands - DML Commands - DCL Commands - Usage of Sub Queries in DML and Create-SQL - Solving queries using built-in functions - Simple programs in PL/SQL block - Exception Handling in PL/SQL - Programs using Implicit Cursors - Programs using Explicit Cursors - Procedures & User-defined functions - Creation of Triggers
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications
Reference Books	Ramez Elmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, Pearson Education, New Delhi
Website and e-Learning Source	http://awtrey.com/tutorials/dbeweb/database.php http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia-database http://www.tutorialspoint.com/dbms/index.htm http://www.tutorialspoint.com/plsql/index.htm

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of relational database management systems, including DDL, DML, DCL commands, SQL queries, built-in functions, PL/SQL blocks, cursors, procedures, functions, and triggers.
CO2	K3	Apply SQL and PL/SQL programming techniques to perform database creation, data manipulation, subquery execution, exception handling, and cursor-based operations in relational database environments.
CO3	K4	Analyze database operations and PL/SQL program execution by examining query structures, cursor mechanisms, exception handling procedures, and trigger-based event processing for efficient database management.

CO4	K5 & K6	Evaluate database programming strategies and create robust database applications using PL/SQL constructs, user-defined procedures, functions, triggers, and secure transaction techniques.
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		DATA STRUCTURES AND ALGORITHMS - PRACTICAL								
Category		CORE		Paper Number			CORE IX			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	5	I	II	3	5	50	50	100
Course Outline		1. Implementation of Merge sort and quick sort Algorithms 2. Implementation of Binary Search Tree 3. Red Black Tree Implementation 4. Implementation of Heap Implementation 5. Implementation of Fibonacci Heap Implementation 6. Implementation of Graph Traversals 7. Implementation of Spanning Tree Implementation 8. Shortest path Algorithms(Dijkstra's, Bellman Ford Algorithms) 9. Implementation of Matrix Chain Multiplication 10. Activity selection and Huffman coding Implementation								

Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms: Third Edition”, The MIT Press, 2014.
Reference Books	Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2014
Website and e-Learning Source	1. https://goalkicker.com/AlgorithmsBook/ 2. http://algs4.cs.princeton.edu/home/ 3. techread.dev/en/books/about/algorithm...

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain fundamental algorithm design and data structure concepts, including algorithms, search trees, heaps, graph traversals, shortest path algorithms, dynamic programming, and greedy techniques.
CO2	K3	Apply algorithmic techniques to implement sorting methods, binary search trees, binary heap structures, graph traversal algorithms, shortest path algorithms, and optimization techniques.
CO3	K4	Analyze algorithm performance and computational efficiency by evaluating time complexity, space complexity, data structure behavior, and correctness of graph, tree, and dynamic programming algorithms.
CO4	K5 & K6	Evaluate algorithmic strategies and create optimized solutions by implementing advanced data structures and algorithms such as Red-Black Trees, Fibonacci Heaps, spanning trees, Huffman coding, and dynamic programming models.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	3	1

CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	12	8	6	12	8

Title of the Course		COMPILER DESIGN								
Category		Elective		Paper Number			ELECTIVE III A			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline		UNIT-I : Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling								
		UNIT-II : Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing								
		UNIT-III : Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponc mode, Case study on Lex and Yacc								
		UNIT-IV : Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking								

	UNIT-V: Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman
Reference Books	1. Dhamdhere D.M., “Compiler Construction: Theory and Practice”, McMillan India Ltd., 1983 2. Holub Allen, “Compiler Design in C”, Prentice Hall of India, 1990
Website and e-Learning Source	1. https://www.geeksforgeeks.org/compiler-design-tutorials/ 2. https://www.tutorialspoint.com/compiler_design/ 3. https://www.javatpoint.com/compiler-tutorial 4. https://onlinecourses.nptel.ac.in/noc19_cs01/preview 5. http://ecomputernotes.com/compiler-design

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of compiler design, including structure of compilers, phases of compilation, lexical analysis, syntax analysis, semantic analysis, intermediate code generation, code optimization, and error handling concepts.
CO2	K3	Apply compiler construction techniques such as lexical analysis using finite automata, parsing techniques, grammar processing, symbol table management, syntax-directed translation, and basic code generation methods.
CO3	K4	Analyze compiler processes including parsing, syntax and semantic error detection, symbol table organization, optimization techniques, data flow analysis, and memory management strategies to evaluate program translation efficiency.

CO4	K5 & K6	Evaluate compiler optimization strategies and create efficient code generation mechanisms, register allocation techniques, DAG-based optimization, loop optimization, peephole optimization and advanced code generation algorithms.
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		INTELLIGENT SYSTEMS								
Category		Elective		Paper Number			ELECTIVE III B			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline		UNIT-I : Artificial Intelligence: AI problems-AI technique- Problem Search:- Production Systems – Problem Characteristics –Production system characteristics- Heuristic Search techniques: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis								
		UNIT-II : Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations –Frame problem –. Using Predicate Logic: Representing simple facts in logic -Representing Instance and ISA relationships – Computable functions and predicates – Resolution								

	UNIT-III : Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. Knowledge representation summary: Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques
	UNIT-IV : Rule-based expert systems: Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- Fuzzy expert systems: Introduction- Fuzzy sets- Linguistic variables and hedges-Operations - Fuzzy rules- - Building a fuzzy expert system
	UNIT-V: Artificial neural networks: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- Robotics: Introduction-Robot hardware-Perception-Moving-Robotic software architecture.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Elaine rich and Kelvin Knight, “Artificial Intelligence “, Tata McGraw hill Publication, 3rdEdition, 2009. [Unit – I,II,III] 2. Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter 6] 3. Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 rd Edition Pearson Education[Unit V-Chapter 25-Robotics]
Reference Books	1. “Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 rd Edition, Pearson Education. 2. “Artificial Intelligence “, George F Luger , 4thEdition , Pearsons Education Publ, 2002. 3. “Foundations of Artificial Intelligent And Expert Systems”, V S Janaki Raman, KSarukesi, P Gopalakrishnan, Macmillan India Limited

Website and e-Learning Source	1. https://www.techopedia.com/definition/190/artificial-intelligence-ai 2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm 3. https://data-flair.training/blogs/heuristic-search-ai/ 4. http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf 5. http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf
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CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of Artificial Intelligence, including problem-solving techniques, search strategies, production systems, heuristic search methods, and basic knowledge representation concepts.
CO2	K3	Apply AI concepts such as logical reasoning, predicate logic, rule-based systems, knowledge representation techniques, and search algorithms to solve structured AI problems.
CO3	K4	Analyze AI systems and knowledge representation approaches, including inference mechanisms, rule-based reasoning, fuzzy logic systems, and semantic representation structures to evaluate problem-solving strategies.
CO4	K5 & K6	Evaluate AI methodologies and create intelligent systems using expert systems, fuzzy logic, neural networks, and robotic architectures for real-world problem-solving applications.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3

Total Score	9	11	12	8	6	12	8
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Title of the Course		ROBOTICS AND ITS APPLICATIONS								
Category		Elective		Paper Number			ELECTIVE III C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline										
		UNIT-I : Introduction -Definition of Automation-Mechanization Vs Automation-Advantages-Goals-Social Issues-Types-Current Emphasis in Automation-Issues in automation in Factory Operations-Strategies of Automation								
		UNIT-II : Introduction -History of Robots- Definition- Laws of Robotics-Characteristics-Components-Comparison of the Human and the Robot Manipulator-Robot Wrist and End of Arm Tools-Robot Terminology-Robotic Joints-Classification-Selection-Workcell-Robotics and Machine Vision-Applications								
		UNIT-III : Robot Components: Sensors: Exteroceptors Sensors -Tactile Sensors -Proximity Sensors-Range Sensors-Machine Vision Sensors-Velocity Sensors-Proprioceptors-Robots with sensors- - End Effectors: Grippers-selection of grippers-Gripping mechanism-tools-Types of Grippers- Drives: Pneumatic, Hydraulic, Electric Actuators								

	UNIT-IV : Transformations: Introduction to Manipulator Kinematics -Homogeneous Transformations-Robot Kinematics-Manipulator Path Control-Robot Dynamics- Robot Programming Techniques: Online programming- Lead-through Programming-Offline Programming-Task Level Programming-Motion Programming-Robot Programming Languages-Robot languages and its types
	UNIT-V: Applications of Robots: Robot Capabilities-Application of Robots-Manufacturing Applications-Material handling applications Robotics and Artificial Intelligence: Vision-Voice communication-Planning-Modelling-Adaptive control-Error monitoring and recovery-Autonomy and intelligence in robots-Expert systems in robotics
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Gupta.A.K, Arora. S. K., Industrial Automation and Robotics, Mercury Learning and Information, 2017(Unit I,II ,III,IV,V) 2. Mikell P Groover, “Industrial Robotics”, Mc GrawHill, 2012.(Unit III: Drives :Fundamentals of Robot technology -Robot Drive systems, Unit IV: Transformations) 3. D.J.Todd, “Fundamentals of Robot Technology”, An Introduction to Industrial Robots, Teleoperators and Robot Vehicles, Wiley,1986.(Unit V: Robotics and Artificial Intelligence)
Reference Books	1. Thomas. K. Rufuss, “Robotics and Automation Handbook”, CRC Press, 2018 2. Ghoyal.K., Deepak Bhandari, “Automation and Robotics”, S.K.Kataria& Sons Publishers, 2012. 3. John.J. Craig, “Introduction to Robotics: Mechanics and Control”, Pearson, 2018. 4. Gonzalez, Fu Lee, Robotics: Control, Sensing, Vision and Intelligence, Wiley, 1998
Website and e-Learning Source	1. https://builtin.com/robotics 2. https://www.elprocus.com/robot-sensor/ 3. https://sp-automation.co.uk/the-top-seven-types-of-robots/ 4. https://robots.ieee.org/learn/types-of-robots/ 5. https://www.intel.in/content/www/in/en/robotics/types-and-applications

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Describe and explain the fundamentals of factory automation, robotic components (joints, sensors, drives, end effectors), programming methods, and the role of artificial intelligence in robotics.
CO2	K3	Apply automation strategies, robotic transformation principles, programming languages, and actuation systems to specify configurations for robot workcells and material handling operations.
CO3	K4	Analyze manipulator kinematics, path control dynamics, sensor feedback mechanisms, and machine vision integration to optimize robotic system performance.
CO4	K5 & K6	Evaluate and design integrated automated factory workflows, gripper mechanisms, error recovery systems, and autonomous robotic applications for manufacturing environments.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	2	1
CO2	2	2	3	2	1	3	2
CO3	2	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	10	10	10	5	11	8

CO-PSO Mapping

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	2	2
CO2	2	3	3	2	1	3	3
CO3	2	3	3	2	1	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	12	8	5	11	10

Title of the Course				SOFTWARE PROJECT MANAGEMENT						
Category		Elective		Paper Number			ELECTIVE IVA			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline										

	UNIT-I : Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.
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	UNIT-II : Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.
	UNIT-III : Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.
	UNIT-IV : Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling
	UNIT-V: Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002

Reference Books	1. Pankaj Jalote, “Software Project Management in Practice”, Addison Wesley 2002. 2. Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition.
Website and e-Learning Source	1. https://higherred.mheducation.com/sites/0077109899/information-center-view/ 2. https://www.tutorialspoint.com/software_engineering/software_project_management.htm 3. https://www.smartsheet.com/content/software-project-management 4. https://www.philadelphia.edu.jo/academics/lalqoran/uploads/SPM_Chapter_1-%202016%204.ppt 5. https://cs.gmu.edu/~kdobolyi/cs421/projectmanagement.ppt

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of software engineering management, including product development life cycle, software development models, process standards (SEI CMM, ISO), competencies, and basic project management concepts.
CO2	K3	Apply project management techniques such as project selection, team formation, project planning, work breakdown structure (WBS), scheduling, and resource allocation to manage software projects effectively.
CO3	K4	Analyze software project parameters including cost estimation, effort estimation models (COCOMO, SLIM), risk assessment, scheduling methods (PERT, CPM), and organizational planning to evaluate project feasibility and performance.
CO4	K5 & K6	Evaluate software project management practices and create comprehensive project management solutions including quality assurance plans, configuration management systems, legal compliance strategies, and optimized software development frameworks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		SOFTWARE TESTING								
Category		Elective		Paper Number			ELECTIVE VC			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline		UNIT – I SOFTWARE QUALITY ASSURANCE Introduction to Software Quality Engineering : What is software quality – Benefits of software quality – Software development life cycle model – Types of defects – Definitions used in software quality engineering - Software Quality Assurance and Quality Control - Software Configuration Management (SCM).Software Quality Assurance : Benefits of SQA – Role of SQA – SQA people – SQA plan – What is process – Process frame works. Reviews, Inspections and walkthroughs : Management and Technical reviews -Inspections and walkthroughs – Inspection forms and check lists – Rate of Inspection – Inspection metrics- Estimating total number of defects in the software.								

	UNIT – II TESTING TECHNIQUES Introduction to Testing : Guiding Principles of testing – Composition of testing team – Essential skills of a tester – Types of Testing – Evaluating the quality of test cases – Techniques for reducing number of test cases – Requirements for effective testing – Test Oracle – Economics of Software testing – Handling defects – Risk in software testing – Requirements traceability matrix. White box (Structural) Testing : Introduction to control flow graph – Control flow testing – Basis path testing – Linear Code Sequence And Jump (LCSAJ) coverage or JJ – path coverage – Loop testing – Data flow testing – Slice-based testing – Pitfalls of white box testing – Tools for white box testing. Integration Testing : Types of Integration testing – Functional Decomposition based Integration – Call graph-based Integration – Path-based Integration – Smoke testing. UNIT – III FUNCTIONAL & NON-FUNCTIONAL TESTING Functional Testing : Logic-based Testing – State Transition Testing – Use Case-based Testing – Syntax Testing – Domain Testing – Petry Net-based testing – Tools used in Functional testing. Non-functional, Acceptance and Regression Testing : Non-functional Testing – Acceptance Testing - Regression Testing. UNIT – IV INCORPORATING SPECIALIZED TESTING TECHNIQUES Testing of OO Software and Agile Testing : Basics of OO system – Overview of UML diagram – OO Testing – Quality Metrics for OO Software – Agile Testing. Test Management: Activities in Test Management – Evaluation of Test Effectiveness – Release Management – Tools used in Test management. Cloud Testing: Introduction to Cloud computing – Cloud testing – Testing as a Service(TaaS). UNIT – V TEST AUTOMATION & QUALITY METRICS Test Automation : Advantages and disadvantages of test automation – Activities in test Automation - Test Automation Frame work – Tools for Test Automation – Script languages in Test Automation. Metrics for Software Quality : Categories of Software metrics – Metrics program – Types of Metrics – Some Commonly used Software Metrics. Tools for Quality Improvement: Basic Quality Control Tool – Check sheet – Cause and effect Diagram – Pareto Diagram – Histogram – Scatter Plot – Run chart – Control Chart – Orthogonal defect Classification.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)

Skills acquired from this course	Get the ideas to test the different software
Recommended Text	1. Anirban Basu, “Software Quality Assurance, Testing and Metrics”, PHI, 2015. 2. Sandeep Desai, Abhishek Srivastava, “Software Testing A Practical Approach”, PHI , 2016.
Reference Texts	1. Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing Principles and practices”, Pearson, 2012. 2. Aditya P Mathur, “Foundations of Software Testing”, Pearson, 2011

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain the fundamentals of software quality assurance, including software quality engineering concepts, SDLC, defect types, SQA and SCM principles, reviews, inspections, walkthroughs, and basic testing concepts.
CO2	K3	Apply software testing techniques including white-box, black-box, integration, functional, and non-functional testing methods, along with test case design, defect handling, and test management tools.
CO3	K4	Analyze software quality processes by evaluating test strategies, inspection metrics, testing effectiveness, risk in testing, OO testing approaches, agile testing methods, and cloud testing frameworks.
CO4	K5 & K6	Evaluate software quality assurance practices and create optimized testing frameworks using test automation, quality metrics, SQA planning, defect classification tools, and continuous quality improvement techniques.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3
Total Score	10	9	9	10	4	10	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		OBJECT ORIENTED ANALYSIS AND DESIGN								
Category		Elective		Paper Number			ELECTIVE IVC			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline										
		UNIT-I : Object Basics : Object- oriented Philosophy – Object – Object State, Behaviours and Methods. Encapsulation and Information Hiding – Class Hierarchy – Polymorphism, Aggregation, Object Containment, Meta Classes.								
		UNIT-II : Object Oriented Methodologies: Rumbaugh Object Model, Booch Methodology- Jacobson Methodology, Patterns, Frameworks and Unified Approach.								
		UNIT-III : Object Oriented Analysis: Business Object Analysis– Use Case Driven Approach – Use Case Model. Object Analysis – Noun Phrase Approach – CRC – Identifying Object Relationships and Methods.								
		UNIT-IV : Object Oriented Design: The Design Process – Design Axioms – Corollaries – Design Patterns – Designing Classes. Software Quality: Tests- Testing Strategies – Test Cases – Test Plan – Continuous Testing – Mier’s Debugging Principles.								
		UNIT-V: UML and Programming: Introduction – State and Dynamic Models – UML Diagrams – Class Diagrams – Use Case Diagrams- UML Dynamic Modeling.								
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)								

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Ali Brahami, Object Oriented Systems Development, Tata-McGraw Hill, New Delhi.
Reference Books	1. Martin Fowler, Kendall Scott, UML Distilled- Applying the Standard Object Modeling Language, Addition Wesley. 2. Grady Booch, (1994), Object-oriented Analysis and Design with applications, 2nd Edition, Addition Wesley.
Website and e-Learning Source	1. http://www.slideshare.net/helghareeb/object-oriented-analysis-and-design-12164752 2. http://www.uml-diagrams.org/uml-object-oriented-concepts.html 3. http://www.tutorialspoint.com/object_oriented_analysis_design/index.htm 4. https://www.mppmu.mpg.de/english/kluth_oo_intro.pdf 5. http://www.agilemodeling.com/artifacts/useCaseDiagram.htm

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Recall and explain object-oriented fundamentals including objects, classes, encapsulation, inheritance, polymorphism, aggregation, object containment, and basic UML concepts.
CO2	K3	Apply object-oriented methodologies and analysis techniques such as Rumbaugh, Booch, Jacobson models, use case modeling, CRC analysis, and object identification methods.
CO3	K4	Analyze object-oriented systems by evaluating relationships, design processes, design axioms, test strategies, debugging principles, and UML-based system modeling.
CO4	K5 & K6	Evaluate object-oriented design approaches and create structured software solutions using design patterns, class design techniques, UML diagrams, and dynamic modeling for real-world applications.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	2	1	2	1
CO2	2	2	3	2	1	2	2
CO3	2	3	2	3	1	3	2
CO4	3	3	3	3	1	3	3

Total Score	10	9	9	10	4	10	8
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CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	1
CO2	2	3	3	2	1	3	2
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	11	8	6	12	8

Title of the Course		REACTIVE NATIVE								
Category		SKILL		Paper Number			SKILL I			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Course Outline		UNIT I: Getting started with React Native - Introducing React and React Native - Understanding how React Native works - React Native's strengths - React Native's drawbacks - Creating and using basic components - Understanding React: Managing component data using state - Managing component data using props								
		UNIT II: React component specifications - React lifecycle methods - Building first React Native app - Laying out the todo app - Coding the todo app - Opening the developer menu -Continuing building the todo app								
		UNIT III: Developing applications in React Native: Introduction to styling - Applying and organizing styles in React Native - Styling view components - Styling Text components - Styling in depth - Platform-specific sizes and styles - Using transformations to move, rotate, scale, and skew components - Using flexbox to lay out components								
		UNIT IV: Implementing cross-platform APIs - Using the Alert API to create cross-platform notifications - Using the AppState API to detect the current application state - Using the AsyncStorage API to persist data - Using the Clipboard API to copy text into the user's clipboard								

	UNIT V: Using the Dimensions API to get the user's screen information - Using the Geolocation API to get the user's current location information - Using the Keyboard API to control the location and functionality of the native keyboard - Using NetInfo to get the user's current online/offline status - Getting information about touch and gesture events with Pan Responder
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Acquire the knowledge about React Native
Recommended Text	Nader Dabit, "React Native in Action", Manning Publications Co., 2019.
Reference Texts	1. Bonnie Eisenman, "Learning React Native - Building Native Mobile Apps with JavaScript", Second Edition, O'Reilly Media, Inc., 2018. 2. Jonathan Lebensold, "React Native Cookbook", O'Reilly Media, Inc., 2018
Web References	1. https://www.netguru.com/glossary/react-native 2. https://www.oreilly.com/library/view/learning-react-/9781491929049/ch01.html 3. https://www.tutorialspoint.com/react_native/index.html

CO	Bloom's Level	Course Outcome Statement
CO1	K1 & K2	Describe and explain the core architecture of React Native, including its strengths, drawbacks, state/prop data management, component lifecycle methods, and cross-platform API behaviors.
CO2	K3	Apply basic components, Flexbox layout rules, component styles, and device-specific transformations to construct responsive user interfaces.
CO3	K4	Analyze platform-specific styling constraints, component lifecycles, application state flows, and asynchronous data persistence mechanisms to troubleshoot cross-platform mobile apps.
CO4	K5 & K6	Evaluate and design comprehensive mobile applications featuring offline data storage, gesture-based interactions (PanResponder), and cross-platform native API integrations (Geolocation, NetInfo, Alert).

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	2	1
CO2	2	2	3	2	1	3	2
CO3	2	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3
Total Score	10	10	10	10	5	11	8

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	2	1	3	2
CO2	2	3	2	2	1	3	3
CO3	2	3	3	2	2	3	2
CO4	3	3	3	2	2	3	3
Total Score	9	11	10	8	6	12	10